Vitamin D levels in stable COPD patients according to the new GOLD staging

Vitamin D3 and COPD

Hikmet Coban

Department of Pulmonology, Faculty of Medicine, Balıkesir University Education and Research Hospital, Balıkesir, Turkey

Abstract

Aim: This study investigates Vitamin D3 levels in stable COPD patients according to the new GOLD stages.

Material and Methods: 320 stable COPD patients were included in the study. Staging was done according to GOLD 2023 criteria, and the relationship with Vitamin D was examined.

Results: The average Vit D3 level of the COPD patients included in the study was 18.49 ± 10.08, with 59.1% having Vit D3 deficiency and 28.1% having Vit D3 insufficiency. According to GOLD 2023 staging, 20.3% of the patients were classified as GOLD A, 26.6% as GOLD B and 53.1% as GOLD E. Significant differences were found between the groups in terms of Vit D3, %FEV1, %FVC, and age. There was a significant negative correlation between Vit D3 levels and exacerbations in the last year and the mMRC dyspnea scale (respectively r = -0.54 p < 0.0001, r = -0.43 p < 0.0001)). Positive significant correlations were found between Vit D3 levels and %FEV1 and %FVC parameters (respectively r = 0.14 p = 0.004, r = 0.23 p < 0.0001).

Discussion: In this study, in stable COPD patients according to GOLD 2023, Vitamin D levels significantly decrease as the severity of the disease increases.

Keywords

Vitamin D3, COPD, GOLD 2023

Introduction

Chronic Obstructive Pulmonary Disease (COPD) is a widespread, preventable, and treatable disease characterized by persistent airflow limitation and respiratory symptoms due to significant exposure to harmful particles or gases, leading to airway and/or alveolar abnormalities. GOLD (Global Strategy for the Diagnosis, Management, and Prevention of Chronic Obstructive Pulmonary Disease) is the guideline used in the diagnosis and treatment follow-up of COPD. In the GOLD 2017 report, FEV1 was excluded from the COPD staging. This simplified the complex evaluation based on FEV1 and/or the number of exacerbations, as introduced in the 2011 version, by making it dependent only on 'the number of exacerbations and the level of symptoms' [available at: https://goldcopd.org/archived-reports-2017]. The ABCD assessment scheme, which started from GOLD 2017, has in GOLD 2023 emphasized the clinical significance of exacerbations regardless of symptom level and revised the pharmacological treatment initiation recommendation in COPD to the ABE scheme based on the individualized assessment of symptom and exacerbation risk [available at: https://goldcopd.org/archived-reports-2023].

Vitamin D exhibits anti-inflammatory effects, is effective in airway reactions against various stimuli such as gases and toxic particles, and has been shown to prevent airway inflammation [1, 2]. In lung diseases like asthma and COPD, there is a higher risk of vitamin D deficiency [3, 4]. The relationship between vitamin D deficiency and the severity of the disease in COPD patients has been identified [5].

The relationship between the new GOLD stages and Vitamin D levels has not been sufficiently investigated. This study investigates Vitamin D3 levels in stable COPD patients according to the new GOLD stages.

Material and Methods

At Sakarya Training and Research Hospital, 320 patients diagnosed with stable-stage COPD and followed for at least one year were included in the study. The study was conducted between January 2015 and January 2018. Cases without exacerbation symptoms in the three months prior to the study were considered clinically stable. Exclusion criteria included concomitant infection, pleural effusion, congestive heart failure, acute exacerbation, malignancy, rheumatic diseases, pulmonary embolism, restrictive airway disease, conditions affecting Vitamin D metabolism, and usage of Vitamin D and corticosteroids. COPD staging was done according to GOLD 2023 criteria (A, B, E) based on the mMRC dyspnea scale and records of exacerbations and/or hospital admissions in the last year. All patients underwent pulmonary function tests. Values of %FEV1, %FVC, and %FEV1/FVC were recorded. Plasma vitamin D levels in all cases were obtained from hospital records for the last three months. 25 (OH) Vitamin D level was measured using Roche Diagnostics (RD) kit on the E170 device by electrochemiluminescence method. 25 (OH) vitamin D levels of ≤20 ng/mL were defined as vitamin D3 deficiency, those between 20-30 ng/mL as vitamin D3 insufficiency (subclinical deficiency), and those ≥30 ng/mL as adequate vitamin D3 levels [6]. Approval was obtained from the Sakarya University Faculty of Medicine Ethics Committee for the study.

Statistical analyses were performed on IBM SPSS Statistics version 23.0 (IBM Corp. USA). The Shapiro-Wilk test was used to test the normality of variables. Normally distributed continuous variables were expressed as mean ± standard deviation. Non-normally distributed variables were expressed as median (min-max) values. The Kruskal-Wallis test was used for inter-group comparisons of COPD stages with vitamin D levels, and the Pearson correlation test was used for correlation analyses between Vitamin D and other variables. $p < 0.05$ was considered statistically significant.

Ethical Approval

This study was approved by the Ethics Committee of Sakarya University, Faculty of Medicine Clinical Research (Date: 2015-04-15, No: 4762).

Results

320 patients diagnosed with stable period COPD were included

Table 1. General characteristics of the patients

	Median	Min-Max	Mean	Std. Deviation
Gender(F/M)		35/285		
Age	66	34-87		
BMI (kg/m2)	24.90	15.50-42.60		
VitD3 (ng/ml)	16.50	5.0-71.3		
<20	n = 189	%59.1		
20-30	n = 90	%28.1		
>30	n = 41	%12.8		
%FVC			59.52	19.74
%FEV1	45	19-111		
Exacerbation	1	0-8		
GOLD 2023 Staging			**Vit D(Mean)**	
A	n = 65	20.3%	27,37	
B	n = 85	26.6%	22,32	
E	n = 170	53.1%	13,18	
Total	n: 320	100 %	18,49	

GOLD: Global Initiative for Chronic Obstructive Lung Disease, BMI: Body mass index, FEV1: Forced expiratory volume in the first second, FVC: Forced vital capacity

Table 2. Averages of VitD3 and other variables according to GOLD 2023 COPD staging and Kruskal Wallis test results between the stages.

GOLD	VitD3 (ng/mL)	p	%FVC	p	%FEV1	p	Age (years)	p	BMI (kg/m²)	p
A	27.3±11.2		73.9±17.5		61.4±15.5		60.8±9.5		26.0±4.5	
B	22.3±7.8	<0.0001	62.9±17.0	<0.0001	49.2±15.3	<0.0001	65.4±10.1	0.001	25.3±4.6	0.20
Ê	13.1±6.8		52.3±18.3		39.9±16.4		66.3±9.6		24.8±4.6	

GOLD: Global Initiative for Chronic Obstructive Lung Disease, BMI: Body mass index, FEV1: Forced expiratory volume in the first second, FVC: Forced vital capacity

Table 3. Correlation analysis results of Vit D3 and other variables

	r	p
Exacerbation	-0.54	<0.0001
mMRC	-0.43	<0.0001
BMI	+0.04	0.24
Age	-0.15	0.004
%FEV1	+0.14	0.005
%FVC	+0.23	<0.0001

mMRC: Modified Medical Research Council, BMI: Body mass index, FEV1: Forced expiratory volume in the first second, FVC: Forced vital capacity

in the study. General characteristics of the patients are shown in Table 1. 89% of the participants were male, with an average age of 65.0 ± 9.94. The average BMI was 25.2 ± 4.63. According to GOLD 2023 staging, 20.3% of the patients were classified as GOLD A, 26.6% as GOLD B, and 53.1% as GOLD E. The Vit D3 level of the COPD patients included in the study was 18.49 ± 10.08, with 59.1% having Vit D3 deficiency and 28.1% having Vit D3 insufficiency.

Comparisons between the averages of Vit D3, %FEV1, %FVC, age, BMI according to GOLD 2023 COPD stages are shown in Table 2. Significant differences were found between the groups in terms of Vit D3, %FEV1, %FVC, and age, while no significant difference was found in BMI.

Pearson linear correlation results between Vit D3 levels and exacerbations in the last year, mMRC dyspnea scale, BMI, gender, age, %FVC, and %FEV1 in patients diagnosed with COPD are shown in Table 3. There was a significant negative correlation between Vit D3 levels and exacerbations in the last year and the mMRC dyspnea scale. Significant positive correlations were found with respiratory function parameters.

Discussion

To our knowledge, this study is the first to demonstrate the relationship between Vitamin D levels and the new COPD staging. In our study, we found that as the severity of GOLD 2023 staging in stable COPD patients, Vitamin D levels decreased. The GOLD 2023 ABE staging was based on the number of exacerbations in the last year and the mMRC dyspnea scale, and a significant negative correlation was found with Vitamin D levels. In our study, a positive relationship was found between plasma Vitamin D levels and respiratory function parameters.

Vitamin D deficiency in patients with COPD has been frequently demonstrated in many studies [7-13]. A study based in Elazığ found that Vitamin D levels in stable COPD cases were lower compared to a healthy control group [16]. Our study found a Vitamin D deficiency rate of 87.2%.

The association between Vitamin D deficiency and low FEV1 has been shown [13, 15, 16]. A significant positive correlation has also been found between serum 25(OH) Vitamin D concentration and FVC [18]. Similarly, in our study, a significant correlation was found between serum 25(OH)D concentration and FVC and FEV1.

In a study conducted by Jorde et al., correlations were found between 25(OH)D levels, systemic inflammation, disease severity, and disease progression. While exacerbation frequency showed significant differences between GOLD stages, a direct relationship was not found between exacerbations and 25(OH) D levels (15). Studies suggest that Vitamin D plays an anti-inflammatory role in the respiratory tract [17, 18]. In the lungs, Vitamin D helps the host defense functions of both the airway epithelium and immune cells. Burkes et al. reported a relationship between the likelihood of acute exacerbations of COPD in the previous year and Vitamin D deficiency in the patients included in their study, but this relationship disappeared in the following year [19]. The relationship between exacerbation frequency and Vitamin D levels in observational studies continues to be debated. However, a recently published meta-analysis revealed a negative relationship between serum Vitamin D and exacerbations. Additionally, two clinical studies emphasized that Vitamin D3 supplementation reduced the risk of moderate and severe exacerbations in COPD patients [20].

Limitation

Limitations of the study include it being single-centered, the selection of a population from a specific region, and the exclusion of additional comorbidities with COPD.

Conclusion

Vitamin D3 levels can be found to be low in COPD patients due to inflammation, inadequate oral intake, a sedentary lifestyle, and less exposure to sunlight. Our study found Vitamin D3 deficiency in 59.1% of patients and Vitamin D3 insufficiency in 28.1% of patients. Only 12.8% of COPD patients had normal Vitamin D3 levels. It was observed that Vitamin D levels decreased as the severity of the disease increased according to GOLD 2023 staging in stable COPD patients. A significant negative correlation was found between Vitamin D levels and the number of exacerbations in the last year and the mMRC dyspnea scale. Our study also found a positive relationship between plasma Vitamin D levels and respiratory function parameters.

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